

Generator Data Request and NERC Reliability Standards Requirements

10/1/2010

2010 Transmission Customer Forum

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Transmission Planning

SCS Transmission

Presentation Outline

- Reasons for Generator Data Submittals
- Overview of the data included in Generator Data Submittals (steady state data)
- Dynamic Data Requirements
- Possible additional data request in 2010 and beyond

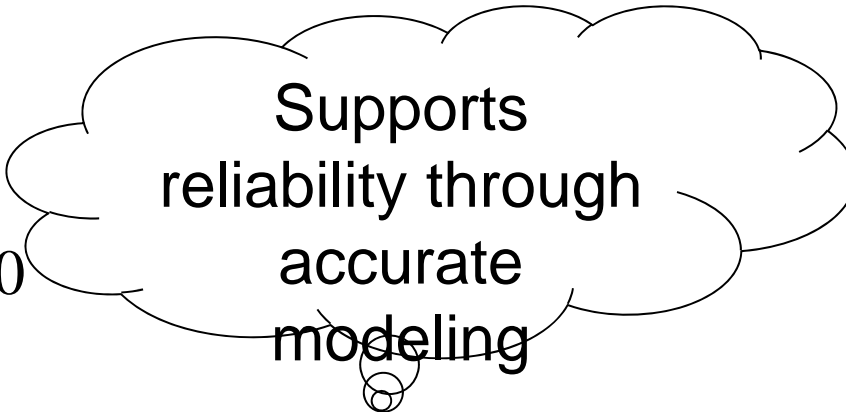
Reasons for Generator Data Submittals

August 14, 2003 Northeast Blackout

- Recommendation 24: Improve quality of system modeling data and data exchange practices.
 - The after-the-fact models developed to simulate August 14 conditions and events found that the dynamic modeling assumptions for generators were frequently inaccurate.

SERC Supplement
System Modeling Data Requirements
NERC Reliability Standards MOD-010
through 015

SERC Supplement
Verification of Generator Real and Reactive Power Capability
NERC Reliability Standards
MOD-024 and MOD-025



Supports
reliability through
accurate
modeling

Standards Committee

- Scope Document
- Meeting Minutes

Documents Link

- SERC Members of NERC Standards Drafting Team
- SERC Drafting Team (RSS) Nomination Form

North American Electric Reliability Corporation (NERC)

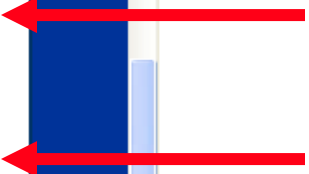
- NERC Reliability Standards

Procedure	Rev. #	Date	Std Comm	NERC Reliability Standard(s)
TTC/ATC Methodology Concerns Procedure	1	1/20/2010	OC	MOD-003-0
TTC and ATC Review Procedure	1	1/20/2010	OC	MOD-002-0
Underfrequency Load Shedding (UFLS)	8	7/7/2010	EC	PRC-006 through 009

Supplements				
Name	Rev. #	Date	Std Comm	NERC Reliability Standard(s)
Actual and Forecast Demands	6	2/28/2008	EC	MOD-016 through 021
Reliability Assessments	3	10/15/2009	EC	TPL-005 & TPL-006
Contingency Reserve Policy	2	12/8/2008	OC	BAL-002
Special Protection Systems (SPS)	6	10/16/2009	EC	PRC-012 through 017
System Modeling Data Requirements	5	12/14/2009	EC	MOD-010 through 016 & NERC Blackout Recommendation # 14
Transmission System Performance	7	10/16/2008	EC	TPL-001 through 004
Under-Voltage Load Shedding (UVLS)	6	10/16/2008	EC	PRC-010, 011, and 020 to 022
Verification of Generator Real and Reactive Power Capability	1	10/15/2009	EC	MOD-024 and MOD-025

Reference Documents - Guidelines				
Name	Rev. #	Date	Std Comm	NERC Reliability Standard(s)
Facility Connection Requirements Guideline	6	5/28/2009	EC	FAC-001-0
Power System Stabilizer Guideline	1	11/15/2008	EC	

Reference Documents - Procedures				
Name	Rev. #	Date	Std Comm	NERC Reliability Standard(s)



SERC Model Data Requirements

- Model Data Validation Requirements:
 - A. Comparison of power flow model to state estimator snapshot
 - B. Reactive load verification of power flow models
 - **C. Validation of transformer tap settings**
 - D. Modeling of significant system disturbances and stressed system conditions
 - **E. Validation of generator excitation systems**
 - **F. Validation of power system stabilizers**

SERC Requirements (cont.)

- Requirement C - **Validation of transformer tap settings**
 - SERC members shall have a procedure to validate the transformer tap settings used in power flow models by comparing to actual equipment settings (field check) at least every five (5) years.

SERC Requirements (cont.)

- Requirement E - **Validation of generator excitation systems**
 - SERC members shall validate the excitation system model parameters of their generating units.
 - A simulation of the step test should be performed for comparison with the test result.
 - Each generator owner will be given a period of seven (7) years (from February 2005) to perform open circuit step response (OCSR) tests on all of the units for which it is required.

Members must be in compliance by: February 1, 2012

SERC Requirements (cont.)

- **Requirement F - Validation of power system stabilizers**
 - SERC members shall validate the power system stabilizer model parameters of their generating units.
 - Units commissioning new PSSs will supply the Transmission Planner applicable test results provided upon commissioning.

SERC Generator MW and Mvar Validations

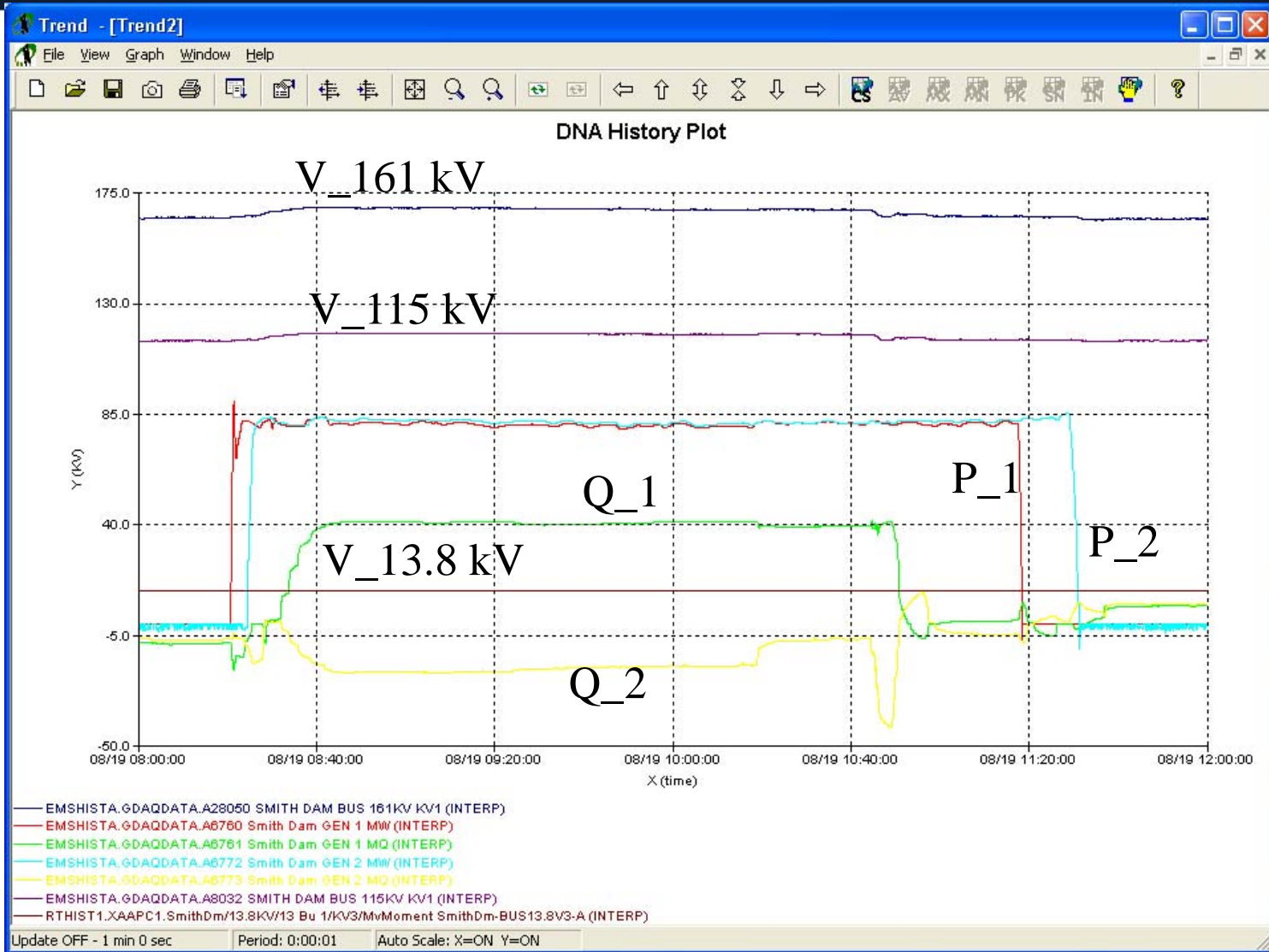
- Supplement for MOD-024 and MOD-025
- Procedures for verification of gross and net real power
 - Annual requirement
- Procedures for verification gross and net reactive power
 - To be done by January 1, 2012

Reactive Power Testing Procedure

- Submit requests to PCC Operations Planning (DuShaune Carter <ddcarter@southernco.com>) at least **three (3) weeks** prior to the test date.
- Data to include:
 - Type of generator tests to be conducted (e.g. production and/or absorption).
 - Expected generator output amount (MW/MVAR).
 - Specific dates, times and durations of testing.
 - Alternate dates and times the testing could be conducted
- The request is evaluated using current forecasted system conditions:
 - Request will be granted, denied or accommodated on an alternate date
 - If granted, requests will be re-evaluate closer to the test date to assess any changes in system conditions that warrant concern

Reactive Power Testing Procedure

- Day of the test:
 - Please notify the appropriate Control Center at least **2 Hours** prior to the start of your test to coordinate the VAR production and absorption.
 - Control Center will monitor and advise through the duration of the test
- When completed, please forward test results to PCC Operations Planning (currently Jim Viikinsalo <jwviikin@southernco.com>).
- Exceptions to the rule:
 - Request that are submitted less than three weeks “may” be accommodated and are evaluated on a case by case basis.



Reactive Power Test SCADA data

SCT's Plan for Meeting the NERC/SERC Requirements

- Develop and update a generator capability database for MW, Mvar and GSU tap verifications.
- Develop a database for generator dynamic model verifications
- Use Generator Data Submittal process to ensure database containing correct data

Generator Data Submittal (2009 and before)

- Confirm your single line is correct
- Report your gross and net real and reactive power capability
- Limiting factor for reactive output
- Excitation system mode of operation, model data available?
- PSS test reports, model data available?
- Speed governing system mode of operation, model data available?
- Underfrequency Relay Setting Coordination
- Confirm GSU taps and data

Generator Data Submittal (in 2010)

- ~~Confirm your single line is correct~~
- Report your gross and net real and reactive power capability
- Limiting factor for reactive output
- ~~Excitation system mode of operation, model data available?~~
- ~~PSS test reports, model data available?~~
- ~~Speed governing system mode of operation, model data available?~~
- ~~Underfrequency Relay Setting Coordination~~
- Confirm GSU taps and data

Generator Data Submittal (2010 and beyond)

- 2010 (Beginning of a five year cycle)
 - Confirm or report any changes to your gross and net real and reactive power capability
 - Confirm or report and changes to the limiting factor for reactive output
 - Confirm or report any changes to GSU taps and data
- 2011 and beyond
 - A letter only asking for
 - confirmation if nothing has changed
 - If anything has changed, provide the changes

Additional Data Requests beginning in 2011

- Dynamic modeling data
 - Generator, Excitation System (including PSS, if applicable) and Governor
 - Give you what model and parameters we have
 - Ask you to confirm if these are still valid
- Exciter Model Data Verification
 - Ask you to supply the record of the most recent validation results (if you have done this)

Dynamic Modeling Data for Plant X

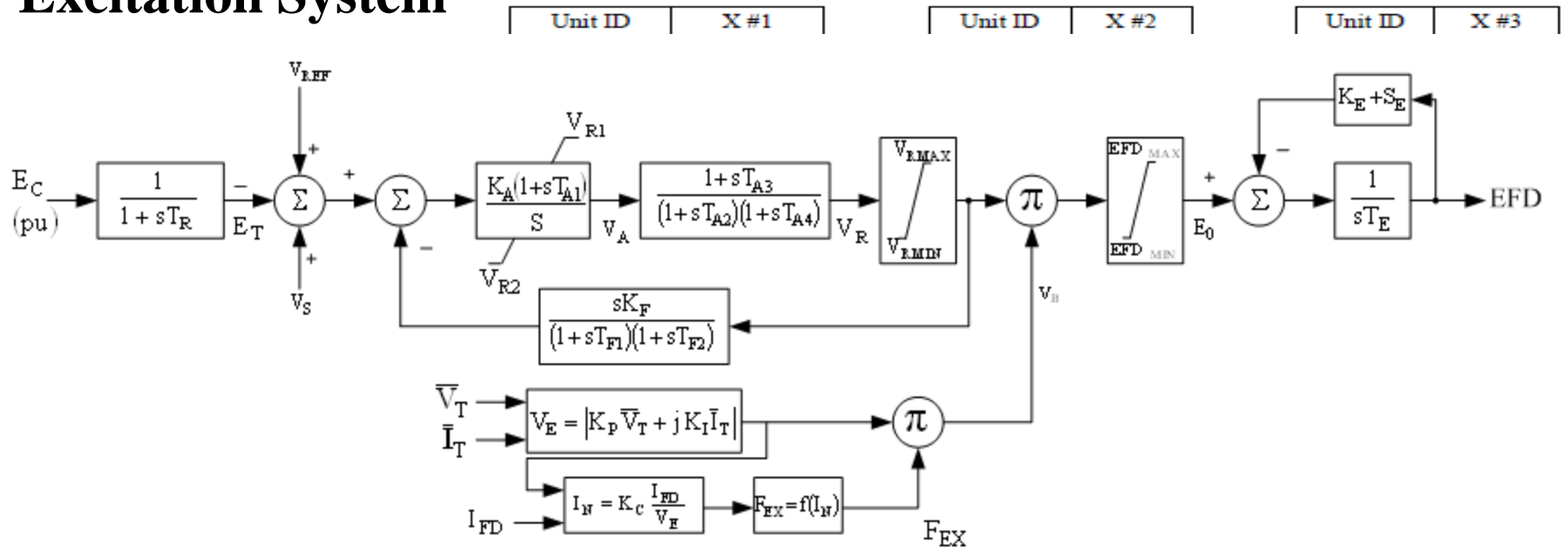
Generator

Generator Model/Parameters:

Unit ID	X #1	X #2	X #3
Rated/Base MVA	180	180	160
Model	GENROU	GENROU	GENROU
$T_{do}^- (> 0)$ (sec)	5.9	5.9	8.02
$T_{do}^- (> 0)$ (sec)	0.033	0.033	0.057
$T_{qo}^- (> 0)$ (sec)	0.47	0.47	1.5
$T_{qo}^- (> 0)$ (sec)	0.081	0.081	0.306
Inertia, H	3.1291	3.1291	3.71
Speed Damping, D	0	0	0
X_d	1.567	1.567	1.62
X_q	1.506	1.506	1.588
X_d'	0.22	0.22	0.186
X_q'	0.386	0.386	0.876
$X_d'' = X_q''$	0.16524	0.16524	0.11
X_1	0.098	0.098	0.083
S(1.0)	0.099	0.099	0.167
S(1.2)	0.43	0.43	0.54
Vendor Datasheets			
Saturation Curve			

X_d , X_q , X_d' , X_q' , X_d'' , X_q'' , H and D are in pu on machine MVA base.

Excitation System



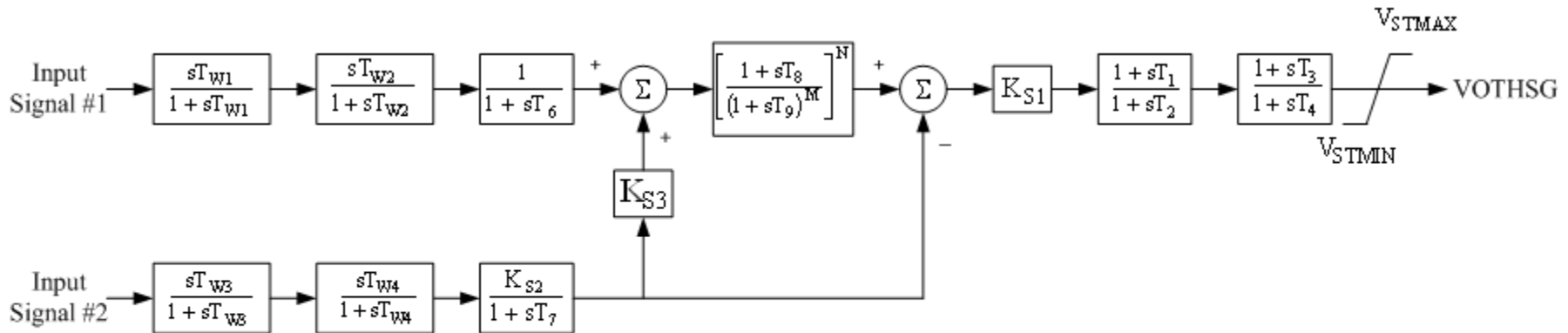
EXPIC1 Block Diagram

E_2	>
SE_2	0.002
K_p	1
K_i	0
K_c	0.2
Datasheet	
Validation	

Power System Stabilizer

Power System Stabilizer Model/Parameters:

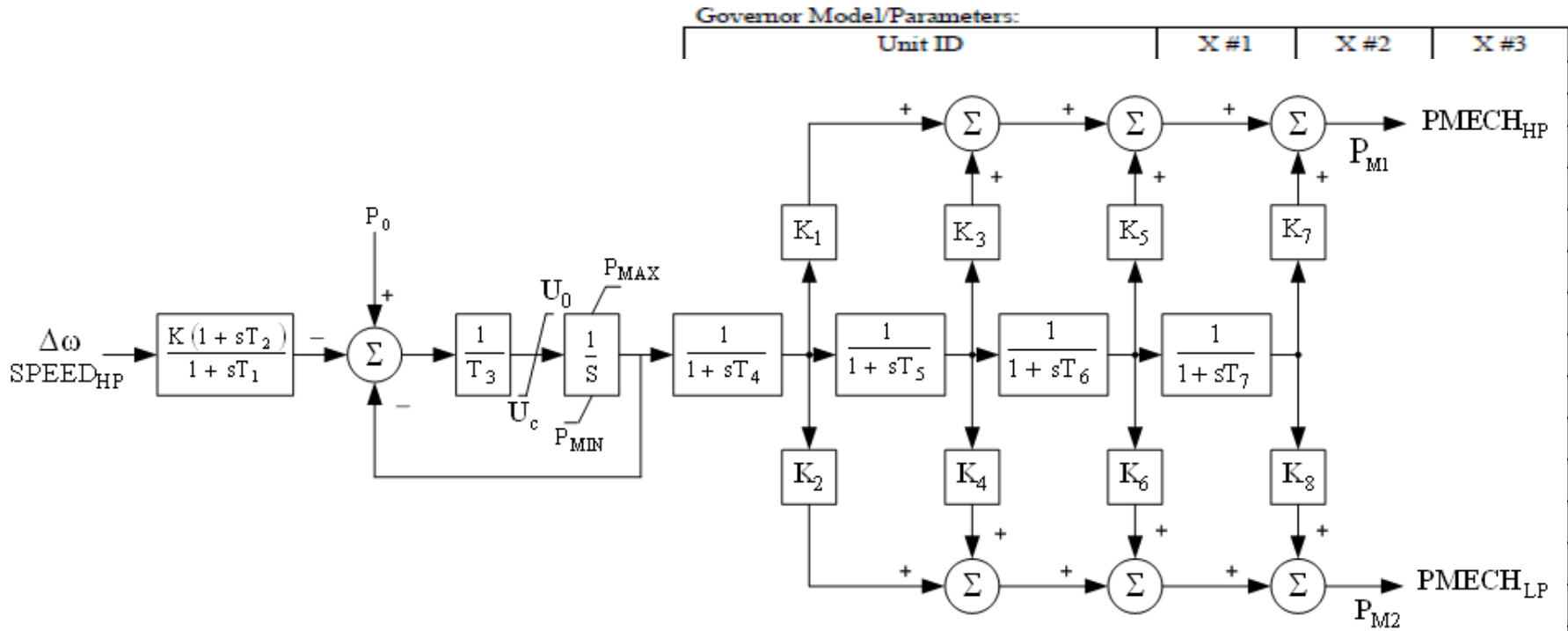
Unit ID	X #2
Model	PSS2A
ICS1, first stabilizer input code:	1
REMBUS1, first	0



PSS2A Block Diagram

T_8	0.3
$T_9 (> 0)$	0.15
K_{S1}	1
T_1	0.21
T_2	0.044
T_3	0.21
T_4	0.044
V_{STMAX}	0.1
V_{STMIN}	-0.1
Datasheet	
Test Report	
Tuning Report	

Governor



IEEEG1 Block Diagram

K_5	0.25	0.25	0.2227
K_6	0	0	0.5459
T_6	0	0	0
K_7	0	0	0
K_8	0	0	0
Datasheet			

References

- [1] IEEE Std. 421.5 – 2005
- [2] IEEE Std. 421.5 – 1992
- [3] Siemens/PTI PSS/E 32.0 Volume II
Program Application Guide

Exciter model/parameters validation

REPORT FOR ALL MODELS

MODELS

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** GENROU **  BUS X-- NAME --X BASEKV MC      C O N S      S T A T E S
                   18.000 1A          1-14          1-6

      MBASE      Z S O R C E      X T R A N      GENTAP
      239.0      0.00000+J 0.20000  0.00000+J 0.00000  1.00000

T'DO T''DO  T'QO T''QO      H  DAMP  XD      XQ      X'D      X'Q      X''D      XL
7.00 0.040  0.58 0.078    4.77 0.00 2.1500 2.0300 0.2700 0.4700 0.2000 0.1500

                   S(1.0)  S(1.2)
                   0.0680  0.5806

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** ESST4B **  BUS X-- NAME --X BASEKV MC      C O N S      S T A T E S
                   18.000 1A          15-31         7-10

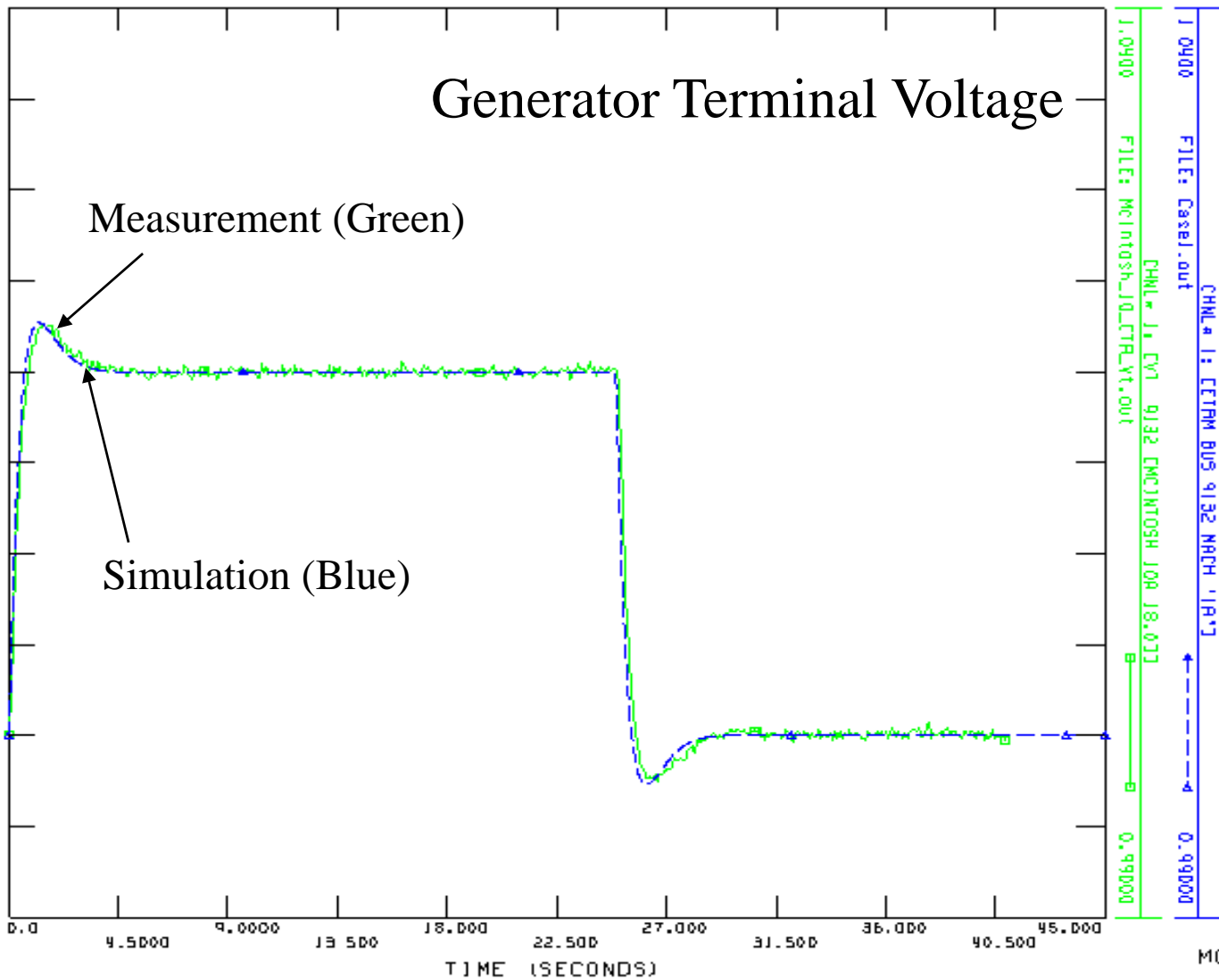
      TR      KPR      KIR      VRMAX      VRMIN      TA      KPM      KIM      VMMAX      VMMIN
      0.000    3.490    3.490    1.000    -1.000    0.010    1.000    0.000    1.000    -0.870

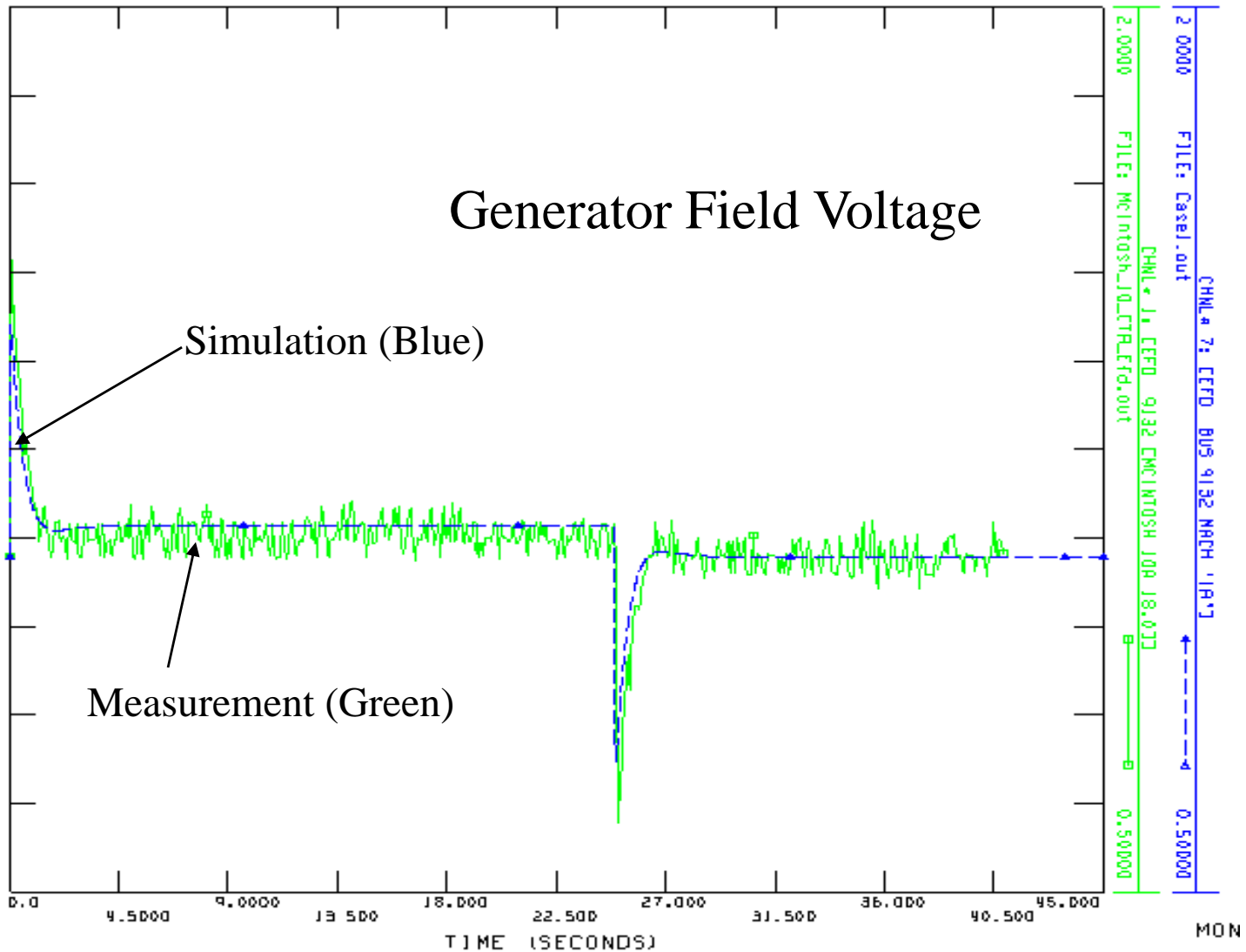
      KG      KP      KI      VBMAX      KC      XL      THETAP
      0.000    5.730    0.000    7.160    0.080    0.0000    0.000

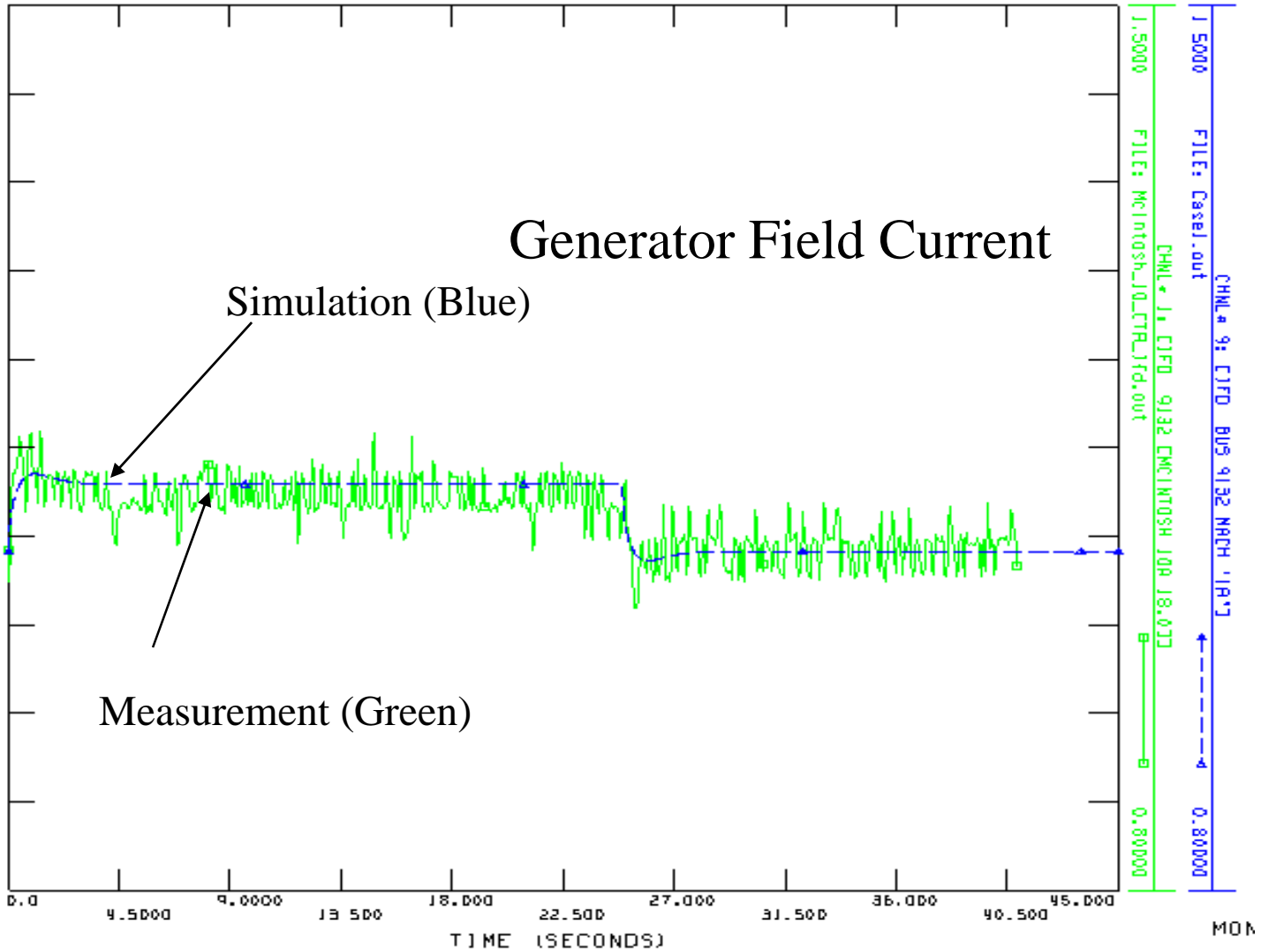
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OCSR Test Field Measurements

							lfd base	535	
							RF	0.140338	
Time		VT	lfd	Efd		Time (sec)	VT	Efd	lfd
0	45.28	17999.55	571.889	80.2575		0.0000	1.0000	1.0690	1.0690
0.032	45.312	18002.7	563.0646	96.38483		0.0320	1.0002	1.2838	1.0525
0.064	45.344	18013.32	558.6524	104.4488		0.0640	1.0007	1.3912	1.0442
0.096	45.376	18030.87	571.9026	117.8402		0.0960	1.0017	1.5695	1.0690
0.128	45.408	18060.3	594.1299	113.2168		0.1280	1.0034	1.5079	1.1105
0.16	45.44	18078.3	602.7744	111.4187		0.1600	1.0044	1.4840	1.1267
0.192	45.472	18096.3	603.3684	109.6207		0.1920	1.0054	1.4600	1.1278
0.224	45.504	18132.3	604.5563	108.4998		0.2240	1.0074	1.4451	1.1300
0.256	45.536	18147.6	605.1502	107.9394		0.2560	1.0082	1.4376	1.1311
0.288	45.568	18162.9	604.8957	107.379		0.2880	1.0091	1.4302	1.1306
0.32	45.6	18193.5	604.3866	105.4279		0.3200	1.0108	1.4042	1.1297
0.352	45.632	18208.08	604.132	104.4524		0.3520	1.0116	1.3912	1.1292
0.384	45.664	18222.75	607.9197	103.4768		0.3840	1.0124	1.3782	1.1363
0.416	45.696	18245.7	613.8694	102.6884		0.4160	1.0137	1.3677	1.1474
0.448	45.728	18260.19	619.7444	101.9101		0.4480	1.0145	1.3573	1.1584
0.48	45.76	18269.19	619.1505	101.4289		0.4800	1.0150	1.3509	1.1573
0.512	45.792	18287.1	617.9626	97.01471		0.5120	1.0160	1.2921	1.1551
0.544	45.824	18295.2	617.3686	94.80763		0.5440	1.0164	1.2627	1.1540
0.576	45.856	18303.3	614.4837	92.60055		0.5760	1.0169	1.2333	1.1486
0.608	45.888	18319.5	608.7139	93.6522		0.6080	1.0178	1.2474	1.1378
0.64	45.92	18324.72	605.829	94.17803		0.6400	1.0180	1.2544	1.1324
0.672	45.952	18329.85	601.5017	94.70385		0.6720	1.0183	1.2614	1.1243
0.704	45.984	18340.2	592.847	93.84122		0.7040	1.0189	1.2499	1.1081
0.736	46.016	18343.8	588.5196	93.40977		0.7360	1.0191	1.2441	1.1000
0.768	46.048	18347.94	595.5825	92.90498		0.7680	1.0193	1.2374	1.1132







Summary

- Generator data submittal has been an effective way to verify model data (steady state)
 - Helps improve the accuracy of our system simulations
- To improve the efficiency, the process is changing to requesting confirmation or for changes every year (except on the 5 year cycles)
 - Steady state modeling data (first year – 2010)
 - Dynamic modeling data (first year – 2011)
 - Exciter model verification (due 2/1/2012)

Call if you have any questions!

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